of T, however the mean ACh-induced increase in coronary flow velocity (ACh 10^{-5} M) was significantly greater ($P = 0.003$) after the administration of T (44 ± 19 vs 50 ± 17 cm/sec). T had no effect on basal coronary flow velocity compared to baseline at any concentration. These preliminary data show little effect of T on coronary flow velocity, but an enhancement of ACh velocity responses by T, suggesting that T may enhance endothelium-dependent coronary vasorelaxation.

786 Ablation of Ventricular Tachycardia

Wednesday, March 19, 1997, 10:30 a.m.–Noon
Anaheim Convention Center, Room A10

10:30

786-1 Is Pacing During Postinfarction Ventricular Tachycardia Necessary to Identify Optimal Sites for Catheter Ablation?

M.C. Burke, H. Paydak, D. Rubenstein, J.G. Kall, D.E. Kopp, R.J. Verdino, D.J. Wilber. *University of Chicago, Chicago, IL, USA*

The utility of pacing data in identifying successful sites for radiofrequency catheter ablation (CA) of sustained monomorphic ventricular tachycardia (SMVT) associated with remote myocardial infarction was evaluated in 18 pts. At each CA site, onset and characteristics of local electrograms (EG) were noted, pacing was performed at 20–50 ms shorter than SMVT cycle length with QRS morphology and S-QRS interval noted, and energy was delivered during SMVT. A site was successful if SMVT terminated during the first 10 s of energy delivery, and could not be reinduced. *Results:* Twenty-four of 29 targeted SMVTs (83%) were successfully ablated (mean cycle length 395 ± 85 ms). EG-QRS intervals at successful sites ranged from 60–220 ms. Neither EG-QRS intervals or EG characteristics differed significantly between successful and failed sites. Entrainment with concealed fusion (ECF) with exact reproduction of QRS morphology was present at all 24 successful, and only 36/84 (43%), failed sites ($p < 0.0001$). (S-QRS) – (EG-QRS) was ≤ 20 ms at 23/24 (96%) successful sites, but at only 17/36 failed sites showing ECF ($p = 0.0005$). The combination of ECF, (S-QRS) – (EG-QRS) < 20 ms, and S-QRS ≥90 ms identified 21/24 successful sites (88%), and was present in only 8/84 (10%) failed sites ($p < 0.0001$). The positive predictive value for a successful CA site using these three pacing variables is 72%, and the negative predictive value 96%. *Conclusion:* The routine use of pacing during postinfarction SMVT appears critical to identifying optimal sites for CA, and minimizing ineffective energy applications.

10:45

786-2 Standard vs Saline Irrigated-Tip Radiofrequency Ablation: Lesion Size in Normal vs Scar Tissue

S.A. Rothman, H.H. Hsia, I.L. Chmielewski, S.F. Cossú, R.L. Vogel, A.E. Buxton, J.M. Miller. *Temple University, Philadelphia, PA, USA*

Success of radiofrequency (RF) catheter ablation for post-infarct ventricular tachycardia is less than for supraventricular tachycardia, in part due to the presence of endocardial scar forming a barrier to effective tissue RF penetration. The effects of standard (S-tip) and saline irrigated (I-tip) RF energy in normal muscle are known but not in scarred myocardium. We performed *in vitro* RF ablation in freshly explanted human hearts (at time of transplantation) from 6 patients with prior transmural infarcts, using the Medtronic CardioRhythm Atakr RF generator and 4 mm S-tip and I-tip catheters in a bath with superfused 37ºC saline. Endocardial scar was 0.5–4 mm thick and varied within the same infarct region. RF was delivered in temperature control mode (70ºC set point) for 30 sec; I-tip catheter had 10 cc/min room temperature saline irrigation. *Results (mean ± SD):*

Endocardium	Catheter (# lesions)	Lesion Measurements		
		Depth (mm)	Area (mm^2)	Volume (mm^3)
Normal	S-tip (4)	4.3 ± 0.5	26 ± 2.6	110 ± 10
	I-tip (3)	6.0 ± 4.0	36 ± 28	294 ± 316
Scar	S-tip (29)	2.6 ± 1.5	15 ± 8	44 ± 35
	I-tip (14)	4.1 ± 2.2*	33 ± 20*	160 ± 154*

*p < 0.05 for I-tip vs S-tip in scarred myocardium

Conclusions: 1) I-tip RF ablation is capable of causing 58% deeper lesions in scar tissue than is standard RF, potentially enabling higher success rates for ablation in post-infarct patients. 2) Lesions made with I-tip RF ablation are smaller in scar than normal myocardium and similar to those made with standard RF catheters in normal myocardium. 3) The risk of perforation or deterioration in ventricular function using I-tip ablation may not be significantly increased if it is applied only in scarred endocardium in the post-infarct patient.

11:00

786-3 Pulsed Current Delivery Combined with Saline Irrigation Produces Deeper Radiofrequency Lesions Without Steam "Pop"

H. Nakagawa, F.H.M. Wittkampf, S. Imai, W.S. Yamanashi, M. Holden, M. Arruda, J.V. Pitha, R. Lazzara, W.M. Jackman. *University of Oklahoma Health Sciences Center and VAMC, Oklahoma City, OK, Japan, University Hospital Utrecht, The Netherlands*

Recent studies show that cooling an ablation electrode by saline irrigation prevents an impedance rise, but high radiofrequency (RF) power often produces a brief, sharp impedance rise with a pop due to sudden release of steam from below the surface of the lesion. This may be the major cause of cardiac perforation during ablation. We hypothesized that pulsed RF current delivery prevents subendocardial steam formation and allows a longer application time at high RF power, producing deeper lesions without "pop". *Methods:* In 8 anesthetized dogs, the skin over the thigh muscle was incised and raised to form a cradle which was superfused with heparinized canine blood (37ºC). A 7 Fr, 5 mm catheter tip electrode with 6 irrigation holes was held perpendicular to the thigh muscle at 10 g contact pressure. 89 RF lesions were produced by delivering RF voltage during saline irrigation (20 ml/min). RF voltage was applied at 60 and 70 volts in continuous mode, and 70 volts in pulsed mode (5 sec on/5 sec off, 4 sec on/5 sec off) for 180 sec or until in the event of pop. Tissue temperature was measured at depths of 3 mm, 5 mm and 7 mm. *Results:* *p < 0.05; Pulsed vs. Contin

n	Voltage (V)	Pulse mode	Duration (sec)	Pop	Peak tissue temp (ºC)		Lesion (mm)	
					3 mm	7 mm	diameter	depth
16	60	Contin	57 ± 18	16/16	98 ± 9	57 ± 7	13.6 ± 1.7	8.5 ± 1.1
24	70	Contin	24 ± 23	24/24	95 ± 12	51 ± 7	13.1 ± 1.8	6.5 ± 1.0
36	70	5 on/5 off	171 ± 24	5/36*	94 ± 9	65 ± 8*	16.5 ± 1.7*	10.3 ± 1.1*
13	70	4 on/5 off	180 ± 0	0/13*	95 ± 10	62 ± 5	15.6 ± 1.8*	9.9 ± 1.3

In pulsed mode, the tissue temperature at 3 mm depth quickly decreased by 8–15ºC between each RF application, while temperature at 7 mm depth steadily increased. *Conclusions:* Intermittent cooling of tissue at shallow depth by the combination of pulsing and saline irrigation allows formation of a large, deep lesion, while decreasing or eliminating steam formation and pop.

11:15

786-4 Entrainment Criteria for the Prediction of Termination of Ventricular Tachycardia in Patients with Coronary Artery Disease

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While entrainment criteria for predicting radio frequency (RF) termination of infarct related ventricular tachycardia (VT) have been described, the number of criteria to be met at each mapping site in order to maximize the predictive accuracy of successful RF ablation is not known. The purpose of this study was to determine the accuracy of a combination of established entrainment criteria in predicting termination of VT by a *single* RF lesion. *Methods:* Entrainment criteria included: 1) an exact QRS match; 2) a return cycle length (CL) within ≤ 10 ms of the VT CL; and 3) presystolic potentials (<70% of VT CL) with an activation time match of the stimulus to QRS and electrogram to QRS. Bipolar pacing was performed on 11 consecutive patients (mean age: 71 ± 12 years, mean ejection fraction: 22 ± 12%) with well tolerated, scar related VT using electrodes 1 and 3 of the mapping catheter while recordings were obtained from bipolar pair 2 and 4. *Results:* RF was delivered at 31 sites during 13 VT and terminated VT at 10 of 11 sites where *all* entrainment criteria were met and failed to terminate VT at all 20 sites with 1 to 3 entrainment criteria present ($p < 0.001$). The positive predictive value of VT termination for *all* entrainment mapping criteria was 91%. Nine of 13 VT (69%) could not be reinitiated during pre-discharge testing .

($p < 0.001$)	VT Termination		
	Yes	No	Total
All entrainment criteria	10	1	11
1–3 entrainment criteria	0	20	20

Conclusion: To maximize success and minimize lesions, the presence of *all* entrainment criteria should be sought prior to RF ablation.